CANADIAN ATLAS OF PREMATURE MORTALITY

1992-2015

CROSS-PROVINCIAL COMPARISONS







AUTHORS

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OVERVIEW

This report of mortality trends in Canada between 1992 and 2015 was created to describe adult premature deaths (between ages 18 and 74). The report compiles data across the country to provide regional comparisons of premature mortality. Analyses for this report were based on deaths occurring among ages 18–74 recorded in the Canadian Vital Statistics Database (CVSD), linked to population counts in the respective geographic areas.

This report describes sex-specific adult premature mortality rates, at levels of 1) provinces/territories, 2) census divisions, 3) age groups, 4) causes of death, and 5) area-based socioeconomic status. The study period was 1992 to 2015, divided into three eras: 1992–1999, 2000–2007, and 2008–2015.



HIGHLIGHTS

Geography

- Overall, premature mortality rates in Canada decreased from 1992–1999 to 2008–2015. The greatest reductions in mortality were larger in Ontario and Canada for males, and in British Columbia and Ontario for females. An exception to this trend was female mortality in Newfoundland, which increased by 14%.
- In the 2008–2015 period, the highest premature mortality for both males and females were found in Newfoundland, Nova Scotia, and Nunavut.
- There was variation in declines at the census division level for both male and female mortality; the greatest reductions were found in census divisions in southern Alberta and British Columbia. The greatest increases were found in the areas within Ontario.

Age and Cause of Death

- Adult premature mortality rates declined over time from 1992–1999 to 2008–2015, with the greatest declines among older age groups. Shifts in and distributions of causes of death varied by age and region.
- From 1992–1999 to 2008–2015, male mortality decreased, with the exception of a 21% increase in Saskatchewan for ages 35–44. Female mortality trends varied, with increases in the Territories, Newfoundland, Manitoba, and Saskatchewan for those under 45 years of ages, and decreases in Prince Edward Island, Quebec, and Ontario among most age groups.
- Deaths in younger age groups were mostly due to external causes, especially among males.
 Deaths in the older age groups tended to be associated with cardiovascular/circulatory diseases and cancer. Trends showed that the proportions due to these respective causes grew over time.
- As of 2008–2015, Alberta had larger proportions of deaths due to external causes for younger age groups compared to other provinces, while the Atlantic provinces had larger proportions of deaths in older age groups caused by cardiovascular/circulatory diseases.

Socioeconomic Status

- Premature mortality rates were higher among residents of low-income areas.
- In 2008–2015, males and females in the bottom income quintiles in Manitoba and Saskatchewan had the highest premature mortality in the country. Males in the top income quintiles in Alberta and Ontario, and females in the top income quintiles in Alberta and British Columbia had the lowest premature mortality.
- For both male and female premature mortality, absolute and relative indices of inequality showed large gaps between those in the top and bottom income quintiles in Manitoba and Saskatchewan, across 2000–2007 and 2008–2015. Area-based SES gaps in mortality also widened substantially over time in the Atlantic provinces.

IMPLICATIONS

- Assessments of regional differences in premature mortality facilitate health system planning and provide bases for linkages with external data for further examination of determinants of premature mortality.
- Evidence of current area-based socioeconomic disparities in premature mortality, which have widened over time, should be further investigated to improve population health.



EXECUTIVE SUMMARY

BACKGROUND

This report of mortality trends in Canada between 1992 and 2015 was created to identify disparities in adult premature deaths (defined as death between ages 18 and 74) and to support public health planning in Canada. This report comprehensively documents data from across the country to provide regional comparisons of mortality. The following presents a descriptive analysis of adult premature mortality over time from 1992 to 2015, across sub-national geographic levels and socioeconomic strata.

Underlying differences exist in the geographic and sociodemographic characteristics of the provinces and territories. Most of the country's population lives in British Columbia (BC), Ontario (ON), and Quebec (QC). The Territories are comprised of younger individuals while the Prairie and the Atlantic provinces have older populations. Statistics Canada has shown regional variations in overall and premature mortality over the past two decades. Previous work from our lab has also found withinprovincial variations across Ontario from 1992 to 2015 (1, 2).

Trends in premature mortality vary over time and geography. This report describes sex-specific adult premature mortality rates in Canada, at different levels of 1) provinces/territories, 2) census divisions, 3) age groups, 4) causes of death, and 5) area-based socioeconomic status. The study period covered in this report includes 1992 to 2015, divided into three eras: 1992–1999, 2000–2007, and 2008–2015.

KEY FINDINGS

Geography

In the most recent era (2008–2015), Newfoundland (NL), Nova Scotia (NS), and Nunavut (NU) had the highest premature mortality for both males and females, while the lowest rates were observed in Alberta (AB), British Columbia (BC), and Ontario (ON). Between 1992–1999 and 2008–2015, reductions in male mortality were larger in Central Canada (Ontario and Quebec). Declines were observed in female mortality rates across the country, especially in BC and ON, with the exception of a 14% increase in NL compared to 1992–1999.

Variation in mortality trends was seen at the census division level. The greatest declines in mortality were found in divisions in southern AB and BC, while the largest increases were found in ON. In 2008–2015, census divisions with high male mortality rates were concentrated in Manitoba (MB), and those with low rates were concentrated in AB. In 2008–2015, the highest female mortality rates were found in divisions in MB and Quebec (QC), and lowest were found in AB, BC, and ON. Within provinces, the widest range of premature mortality rates between census divisions were in AB, ON, and QC for both sexes. The smallest geographic disparity in male mortality was in NL, and in female mortality in Saskatchewan (SK).

Age

Adult premature mortality rates increased with age, although the age distribution of mortality varied by province. In 2008–2015, mortality rates in the Territories were among the highest across all ages for both sexes. In addition, male mortality rates were high in MB and SK for those under 55, and in NL for those 55 years of age and older; female mortality rates were high in MB and SK for those under 55, in MB for ages 55–64, and in NL for ages 65–74. Male mortality rates were lowest in ON and QC for those

under 55, and in BC for those 55 years and older. Female premature mortality was lowest in PEI for ages 18–34, in ON and QC for ages 35–44, and in BC and ON among those 45 and older.

Reductions in premature mortality rates from 1992–1999 to 2008–2015 were greater with older age. Decreases in male mortality were observed in QC among those under 35 and older than 55 years of age, in BC among those under 45, in Prince Edward Island (PEI) among those aged 45–64 years, and in NL among those aged 65–74 years. Male mortality rose in SK for ages 35–44, and in NL for those under 45 years of age. Female premature mortality decreased greatly in PEI for ages 18–35 and 55–64, in QC for ages 35–54, in ON for ages 45–54 and 65–74, and in NL for ages 55–64 years. Mortality rates increased in females under 45 in NL, MB, and SK, and in ages 45–54 in SK.

Causes of Death

In 2008–2015, most premature deaths in the youngest age group (18–34 years) were due to external causes, which includes injuries and poisonings. Among ages 35–44, males died most commonly from external causes, and females from cancer. Among ages 45–54, males died largely from cardiovascular/circulatory diseases as well as cancer, and females from cancer. Among ages 55 and older, cancer was the leading cause of male and female deaths.

Between-province variations in cause of death showed that AB had a larger proportion of deaths due to external causes among males under 55 years of age, and that NL had greater circulatory deaths in males ages 35–45. A larger proportion of female deaths in ages 18–34 were found in AB and MB for external causes, ages 35–44 in the Atlantic region for cardiovascular/circulatory diseases, and ages 45–64 in QC for cancer.

Between 1992–1999 and 2008–2015, the proportion of male deaths due to external causes grew for adults under age 55, and the proportion of deaths by cardiovascular and circulatory diseases decreased in ages 55 and older. The proportion of female deaths due to external causes increased among ages 18–34, and those due to cardiovascular/circulatory diseases decreased among those 55 and older.

Socioeconomic Status (SES)

Premature mortality rates were generally higher among residents of low-income areas, and vice-versa. As of 2008–2015, males and females in the bottom income quintile in MB and SK had the highest mortality in the country. Males in the top income quintiles in AB and ON, and females in the top income quintiles in AB and BC had the lowest premature mortality.

Inequalities measured by slope and relative indices of inequality were substantial in MB and SK across time. Several provinces in the Atlantic region saw small between-quintile differences in 2000–2007, but gaps widened by 2008–2015. These patterns in SES applied to both male and female premature mortality rates.

IMPLICATIONS

Adult premature mortality rates improved over time, with the greatest declines among older age groups. However, shifts in and distributions of causes of death varied by age and region. It is worthwhile for health authorities to assess regional differences to facilitate health system planning, and to conduct linkages with the census to further examine determinants of premature mortality. With evidence of current socioeconomic disparities in mortality, which have worsened over time, socioeconomic differences should also be assessed in system planning to improve population health.



1 INTRODUCTION

BACKGROUND

This atlas is part of a series of projects supported by the OPTIMISE research program at the <u>Population</u> <u>Health Analytics Lab</u>. It presents a descriptive analysis of adult premature mortality over time from 1992 to 2015, across sub-national geographic levels and socioeconomic strata. It was created as a guide to identify disparities in adult premature deaths and to support public health planning in Canada.

The Canadian Health System

The health system in Canada operates primarily at the provincial and territorial levels (3). The ten provinces and three territories were established over time, starting with the *British North America Act* in 1867. A notable legislation enacted within the period of interest was the *Nunavut Act*, which introduced Nunavut as a separate entity from Northwest Territories in April 1999 (4). Each of the thirteen regions receives support from the federal government in the form of funding transfers, while their respective ministries of health are responsible for administering and delivering care within their boundaries (3).

Underlying differences exist in the geographic and sociodemographic characteristics of the provinces and territories. Canada is divided into the following regions: the Atlantic provinces (Newfoundland & Labrador, Prince Edward Island, Nova Scotia, New Brunswick), Central Canada (Ontario and Quebec), the Prairie provinces (Manitoba, Saskatchewan, Alberta), the West Coast (British Columbia), and the three Northern Territories (5). According to the most recent census in 2016, 35.1 million people live in Canada. Central Canada holds the majority of the country's population, with 38% in Ontario and 23% in Quebec, followed by 13% in British Columbia (6). Conversely, the expansive Territories comprise less than 0.5% of the population, and have the lowest densities per square kilometer. Higher proportions of children and younger individuals (under 40 years of age) live in the Territories and the Prairie provinces, while the Atlantic provinces are comprised of older age groups over 50 years (7). Taking together the provincial/territorial characteristics and individual legislative authorities, their amounts of government expenditures also differ. For example, as of 2017, overall spending was greatest in Central Canada, British Columbia, and Alberta, and lowest in the Territories (8). However, the Canadian Institute for Health Information estimated that health spending per person in 2018 was highest in the Territories, and lowest in British Columbia and Ontario (9).

Mortality Reports in Canada

This report is specifically interested in premature mortality, which is a well-established metric of health outcomes in the population and often used as a tool for assessing health system performance (10-12). In Canada, premature mortality is defined as deaths occurring before 75 years of age (13).

The duty to report deaths is under provincial and territorial jurisdictions in Canada. Information is gathered from Medical Certificates of Death, which are then recorded by the regional vital statistics registrars, and compiled by Statistics Canada every calendar year (14). Medical certificates are completed by medical or other authorized professionals, and capture information such as the name, age, and sex of the decedent, place of death, and the immediate and underlying causes of death (15).

Regular publications from Statistics Canada have shown regional variations in overall and premature mortality rates over the past two decades (16). Previous work from our lab has also found substantial within-province variations in mortality across the Local Health Integration Networks and Public Health

Units in Ontario between 1992 and 2015 (1, 2). Examining some of the determinants of these variations, we found widening inequalities by socioeconomic status, where the premature mortality rate of those least materially deprived was decreasing more rapidly over time than those most deprived. We also found that by 2015, the mortality of those living in the most deprived areas had not fallen to the same level as those living in the least deprived areas in 1992 (1).

PURPOSE

The differences in mortality over time and space present a need to summarize trends within and between provinces and territories. The lack of standardized boundaries for public health operations highlights a challenge in conducting geographic analyses across the country. The reporting of geographic trends can facilitate health system planning in the respective regions and allow for linkages with the census. In addition, the likelihood of dying prematurely varies by cause and age, and mortality by cause of death is pertinent to identifying priorities in public health planning. We further describe mortality rates across SES indicators given the important differences across SES and changing patterns over time. This report will describe sex-specific trends in premature mortality in Canada by the following stratifications:

- 1) the provincial and territorial level;
- 2) by age groups;
- 3) causes of death;
- 4) the census division level; and
- 5) across socioeconomic quintiles.

Time trends are examined over the course of 1992 to 2015, divided into three eras: 1992–1999, 2000–2007, and 2008–2015.

METHODS

Data Sources

Deaths were included if they occurred in a known Canadian province or territory in the period of 1992– 2015. Mortality data were from the Canadian Vital Statistics Death Database (CVSD), accessed at the Research Data Centre (17). Data on population sizes were publicly available from the Statistics Canada website (18).

Variable Definitions

The geographic levels of interest were provinces or territories, and census divisions. Names and abbreviations of Canadian provinces and territories can be found in the Appendix Table 1.1. Age groups were categorized into the following ranges: 18–34, 35–44, 45–54, 55–64, and 65–74 years. These age bands correspond to those used in vital statistics reports by Statistics Canada, aggregated into 10-year ranges for stability. Five broad categories were used to classify underlying causes of death: diseases of the cardiovascular and circulatory system, cancer, diseases of the respiratory system, external causes, and other causes. External causes include injuries and poisonings, and other causes of death capturing those not already mentioned, such as diseases of the endocrine, nervous, and musculoskeletal systems. Socioeconomic status was measured by the income level of the dissemination area of residence, such that rates were produced for quintiles one through five, in order of ascending income level. Individual deaths and population counts were restricted to the criteria in each stratification when calculating mortality rates.

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Premature Mortality Rates

Adult premature mortality rates were calculated by dividing the number of deaths by the number of people in the population, among ages 18–74 years. The quotient was then multiplied by 100,000 to be expressed as deaths per 100,000 population. Annual premature mortality rates were calculated for provinces and territories, and era rates for all other geographic, age group, cause of death, and socioeconomic categorizations. Mortality per era was calculated as the total number of deaths in each of the 8-year periods divided by the population sizes in each mid-era year, i.e. 1995, 2003, and 2011, respectively.

Further details of the calculation procedures, stratifications, and data access and confidentiality can be found in the technical appendix.

Indices of Socioeconomic Inequality

The slope and relative indices of inequality were calculated with linear regression of provincial rates on income quintile rank (19). The slope index of inequality (SII) is interpreted as the predicted absolute difference between the top and bottom socioeconomic positions, in units of deaths per 100,000 population. For example, an SII value of 349 deaths per 100,000 can be interpreted to mean that the mortality rate at the lowest socioeconomic position in a population is 349 deaths per 100,000 higher than the mortality rate at the highest socioeconomic position in that same population. The relative index of inequality (RII) is the predicted relative difference, which is a ratio of rates between the quintiles. RII values greater than 1.0 indicate that mortality of those residing in low-income areas is greater than those living in high-income areas. For example, an RII value of 3.49 would indicate that the mortality rate at the lowest socioeconomic position is about three and a half times the rate of those in the highest socioeconomic position is about three and a half times the rate of those in the highest socioeconomic position.



2 PREMATURE MORTALITY BY PROVINCE

CHARACTERISTICS

Canada's population grew substantially over time, from 20 million in 1992 to 26 million in 2015 for those 18–74 years of age. The provinces with greatest population growth were Alberta (AB), by 67%, and British Columbia (BC), by 45%. Since its creation in 1999, Nunavut (NU) has also grown markedly (44%) by 2015, though it remains the smallest population in the country, comprising of 225,000 individuals, as compared to the largest of 10 million in Ontario. The only province whose population size remained stagnant was Newfoundland and Labrador (NL), at about 400,000 individuals.

By sex, males and females are almost evenly split in all provinces and territories. Both male and female populations grew the most in AB and NU, with increases of over 65% between 1992 and 2015. While males and females increased in similar proportions in the provinces between 1992 and 2015, the female populations in the Territories grew more than males, by 46% vs. 36%, respectively. In this adult population, median ages have risen from late-thirties to mid-forties across all provinces, with the exception of NU remaining the youngest with a median age of 36 years.

MORTALITY RATES

Adult premature mortality rates were calculated annually and by era, per 100,000 individuals in the province or territory. All results tables can be found in the Data Appendix.

In the 1992–1999 era, the highest mortality occurred among males in Prince Edward Island (PEI), Nova Scotia (NS), and Quebec (QC), and among females in Manitoba (MB), NS, and QC. In 2008–2015, NU had the highest provincial/territorial premature mortality among the provinces and territories for both males and females, followed by NL and NS, while the lowest rates were in AB, BC, and ON. Annual rates between 2008 and 2015 present similar patterns. However, in 2015, NL surpassed NU for highest premature mortality in both males and females.

Premature mortality declined in Canada between 1992 and 2015. Male mortality in 1992–1999 was higher than that of females (553 vs. 331 per 100,000), but had a greater drop of -21% vs. -13%, respectively, by 2008–2015. At the provincial level, QC and ON saw the greatest reductions in male mortality, while ON and BC had the greatest reductions in female mortality. However, some areas experienced increases in premature deaths. In Yukon (YT) and NL, female mortality rose appreciably by 32% and 14%, and male mortality rose by 10% and 4%, respectively.

For the period between 1992 to 1999, annual and era rates in the Northwest Territories (NT) and NU were combined, as the latter was not officially established until April of 1999. Thus, time trends in NU and NT cannot be compared with the 1992–1999 era. Between 2000–2007 and 2008–2015, mortality rose in NT and NU, and was more pronounced among females.

Across all provinces/territories other than NU and NT, changes over time were greater between the first (1992–1999) and second era (2000–2007), compared to changes between the second (2000–2007) and third era (2008–2015). Percent values of these changes can be found in the Data Appendix (Tables 1.2.3 and 1.3.3).





Figure 2.1. Premature mortality per 100,000 adult males in 2008–2015 across Canadian provinces and territories.



Figure 2.2. Premature mortality per 100,000 adult females in 2008–2015 across Canadian provinces and territories.



3 PREMATURE MORTALITY BY AGE

CHARACTERISTICS

The provincial populations were further stratified, by sex, into age groups of 18–34, 35–44, 45–54, 55– 64, and 65–74 years old for cross-era comparisons. Population sizes, which were the denominators used to calculate premature mortality rates, were evenly distributed by sex for all regions, and remained stable over time. However, the age structure grew older between 1992 and 2015 in all regions of Canada. As of 2008–2015, the Atlantic provinces had the oldest population in Canada, with about onethird of residents aged 55 years and older. The Territories had the highest proportion of those aged 18– 34 years, at around 40% as of 2008–2015, compared to the same age group comprising approximately one-third of the populations in other regions.

MORTALITY RATES

Stratified by age groups, adult premature mortality rates were calculated for each era. Absolute and relative (percent) change between 1992–1999 and 2008–2015 were also calculated. Mortality increased with age for both males and females. Over time, rates have been declining across the country, with greater reductions in the older age groups. Values of mortality rates and percent changes can be found in the Data Appendix.

Male Premature Mortality

For males in 1992–1999, the lowest premature mortality across all age groups were generally found in ON, among age groups up to 44 in NL, and among those 45 and older in AB. BC also had the lowest rates in the country for males 55 and older; however, mortality for the 35–44 age group was the second highest in the country. The highest mortality rates were in the Territories.

In 2008–2015, ON and QC had the lowest male premature mortality for those under 55 years of age, along with PEI for those younger than 45 years old. BC had the lowest mortality rates for males older than 55, followed by ON and QC. The Territories, MB and SK experienced high mortality for those under age 55, and NL for those 55 and older.

Comparing 1992–1999 to 2008–2015, QC had the greatest reductions in male premature mortality. Other provinces with notable declines were PEI among ages 45–64, and NL among ages 65–74. Mortality rates in BC among those younger than 45 years also declined considerably. While mortality decreased in most regions and age groups, rates rose by 21% for males of ages 35–44 in SK, and by 2–3% in those under 45 years old in NL.

Female Premature Mortality

Among females, adult premature mortality rates in 1992–1999 were lowest in NL, ON, and PEI for those under 45, in BC, NB, and ON for those 45–54 years of age, and in AB, BC, and SK for those 55 and older. In 2008–2015, BC and ON generally had the lowest mortality rates across all ages, joined by QC for the 35–44 and 65–74 age groups. Mortality rates for females under 35 in PEI and for those 55–64 years of age in AB were also among the lowest in these respective age groups. Similar to male mortality rates, female mortality rates across all age groups were highest in the Territories. Mortality was also high in MB and SK for those under 55, in MB for those 55–64, and in NL for those 65–74 years of age.



Female mortality declined in Canada between 1992–1999 and 2008–2015. Large improvements over the three eras were observed in PEI for the 18–35 and 55–64 age groups, QC for those in ages 35–54, and ON for those in the 45–54 and 65–74 age groups. In addition, NL also saw a sizeable absolute reduction of 197 deaths per 100,000 females aged 55–64 years. However, mortality increased among those under 45 in NL, MB, and SK, and in SK among those 45–54 years old.



4 PREMATURE MORTALITY BY CAUSE OF DEATH

CAUSES OF DEATH

Using ICD-9 and ICD-10 codes for underlying cause of death, records were grouped into five broad categories: cardiovascular and circulatory, cancer, respiratory, external, and other. The proportion of deaths attributable to each category were calculated among each age group, per province and era. A list of ICD codes in each cause of death category is available in the Technical Appendix (Table 3.1).

MORTALITY RATES

Causes of premature death differed by age. In 2008–2015, external causes accounted for more than two-thirds of male deaths, and close to half of female deaths among those 18–34 years of age. In the 35–44 age group, external causes remained the biggest contributor of male deaths, while cancer and external causes accounted for the greatest proportions among females. The proportion of deaths caused by cancer was larger for both sexes in ages 45–54, but more so for females, while male deaths were dominated by both cardiovascular/circulatory diseases and cancer. In ages 55–74, the greatest proportion of deaths were attributable to cancer for both sexes, with a larger number of deaths from circulatory diseases observed among males than females.

Distributions of causes of death remained relatively stable over time. In male premature mortality, external causes appear to have increased from 1992–1999 to 2008–2015 for those under 55 years of age, while the fraction of circulatory causes for those 55 and over decreased. In female mortality, an increased proportion of deaths from external causes was observed in the 18–34 age group, while patterns in the cause of premature mortality among the 44–54 age group remained similar over time. Similar to male deaths, female deaths among ages 55 and older also saw a reduction over time in circulatory causes and an increase in deaths caused by cancer.

REGIONAL TRENDS

In 2008–2015, regional variations existed in cause of death, and were more apparent for females than males. Compared to the rest of Canada, Alberta had a slightly larger proportion of male premature deaths by external causes among those under 55 years of age, and NL experienced more cardiovascular/circulatory deaths in those aged 35–54 years. Among females in AB and MB, a greater proportion of premature deaths were attributed to external causes for those aged 18–34 years. Across sexes, the Atlantic provinces had larger proportions of cardiovascular/circulatory deaths in ages 35–44, and QC had the highest proportion of cancer deaths in the 45–54 and 55–64 age groups. Distributions of causes of death in 2008–2015, for all provinces, can be found in the Data Appendix.

Male Premature Mortality

Figures 4.1.1 through 4.1.5 present adult premature mortality rates and percent distributions in causes of death for provinces with the least improvements/largest increases (left), and the greatest reductions (right) in premature mortality over time. Saskatchewan had the highest mortality increases over time for male mortality in ages 35 and older; its distribution changed in that fewer deaths in the 2008–2015 era were due to circulatory diseases and cancer as compared to 1992–1999. In BC, male mortality in the 35–44 age group saw a rise in external causes. In QC, where all-cause premature mortality declined between 1992–1999 and 2008–2015 for those ages 45 and older, the proportion of deaths due



circulatory disease were reduced over time. Details on other provinces not shown in the following figures can be found in the Data Appendix.



Figure 4.1.1 Premature mortality rates per 100,000 and % distributions by causes of death in males aged 18–34 years. Between 1992–1999 and 2008–2015, mortality increased by 3% in NL (+2.4 per 100,000) and decreased by 47% in QC (-56.6 per 100,000).



Figure 4.1.2 Premature mortality rates per 100,000 and % distributions by causes of death in males aged 35–44 years. Between 1992–1999 and 2008–2015, mortality increased by 21% in SK (+35.0 per 100,000) and decreased by 37% in BC (-80.5 per 100,000).





Figure 4.1.3 Premature mortality rates per 100,000 and % distributions by causes of death in males aged 45–54 years. Between 1992–1999 and 2008–2015, mortality decreased by 3% in SK (-10.6 per 100,000) and decreased by 31% in QC (-131.8 per 100,000).



Figure 4.1.4 Premature mortality rates per 100,000 and % distributions by causes of death in males aged 55–64 years. Between 1992–1999 and 2008–2015, mortality decreased by 23% in SK (-256.4 per 100,000) and decreased by 38% in QC (-459.0 per 100,000).





Figure 4.1.5 Premature mortality rates per 100,000 and % distributions by causes of death in males aged 65–74 years. Between 1992–1999 and 2008–2015, mortality decreased by 24% in SK (-664.1 per 100,000) and decreased by 41% in QC (-1308.3 per 100,000).

Female Premature Mortality

Figures 4.2.1 through 4.2.5 present rates and distributions in causes of premature female deaths for the provinces with the least improvements/largest increases (left) and greatest reductions (right) over time. The mortality rate in ages 18–34 increased in MB; a larger proportion of premature deaths were attributed to external causes in 2008–2015. Mortality in ages 35–54 in SK also increased relative to the rate in 1992–1999. Where decreases in mortality occurred, the proportions of deaths due to circulatory diseases appear to have reduced over time, especially among females aged 55 years and older.



Figure 4.2.1 Premature mortality rates per 100,000 and % distributions by causes of death in females aged 18–34 years. Between 1992–1999 and 2008–2015, mortality increased by 33% in MB (+15.7 per 100,000) and decreased by 33% in PEI (-12.5 per 100,000).

*Circulatory deaths in PEI have been grouped with 'Other causes' due to suppression of small sample sizes.

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Figure 4.2.2 Premature mortality rates per 100,000 and % distributions by causes of death in females aged 35–44 years. Between 1992–1999 and 2008–2015, mortality increased by 18% in SK (+19.8 per 100,000) and decreased by 32% in BC (-33.7 per 100,000).



Figure 4.2.3 Premature mortality rates per 100,000 and % distributions of causes of death in females aged 45–54 years. Between 1992–1999 and 2008–2015, mortality increased by 5% in SK (+12.2 per 100,000) and decreased by 18% in QC (-46.6 per 100,000).





Figure 4.2.4 Premature mortality rates per 100,000 and % distributions of causes of death in females aged 55–64 years. Between 1992–1999 and 2008–2015, mortality decreased by 17% in SK (-108.1 per 100,000) and decreased by 30% in PEI (-205.2 per 100,000).



Figure 4.2.5 Premature mortality rates per 100,000 and % distributions by causes of death in females aged 65–74 years. Between 1992–1999 and 2008–2015, mortality decreased by 7% in SK (-108.6 per 100,000) and decreased by 30% in ON (-482.6 per 100,000).



5 PREMATURE MORTALITY BY CENSUS DIVISION

CHARACTERISTICS

A census division (CD) is a geographic area set by Statistics Canada for census implementation purposes. Divisions respect major geopolitical boundaries (for example, county limits) and remain consistent over time, with few additions and changes. Canada was divided into 288 CDs for the 2001 Census cycle, and 293 CDs for the 2011 and 2016 cycles.

Across CDs, the population sizes of individuals aged 18–74 years vary greatly, ranging from 1000 to 1.7 million in 1995, and 500 to 2.0 million in 2011. This range reflects the heterogeneous distribution of the Canadian population, which is comprised of both densely populated metropolitan centres as well as sparsely populated areas. Accordingly, mean population sizes per CD also rose from about 72 thousand in 1995 to 85 thousand in 2011.

MORTALITY RATES

Premature mortality rates per 100,000 adults were calculated for all three eras. Denominators used were mid-era population sizes in 1995, 2003, and 2011, respectively, in each census division. Changes in mortality rates between 1992–1999 versus 2008–2015 were calculated as percentages. Due to inconsistencies in boundary definitions and data quality over time, changes in mortality are not shown for the three territories.

Male premature mortality rates in each CD during 1992–1999, 2000–2007, and 2008–2015 are mapped in Figures 5.1.1 through 5.1.3. Comparing mortality rates in 1992–1999 to rates in 2008–2015, reductions occurred mostly in CDs in the southern half of the country (Figure 5.1.4). Increases in male mortality over time varied geographically across CDs.





Figure 5.1.1 Premature mortality per 100,000 males by census divisions across Canada in 1992–1999.



Figure 5.1.2 Premature mortality per 100,000 males by census divisions across Canada in 2000–2007.



Figure 5.1.3 Premature mortality per 100,000 males by census divisions across Canada in 2008–2015.



Figure 5.1.4 Percent change in premature mortality per 100,000 males between 1992–1999 and 2008–2015, per census division.



Female premature mortality rates in each CD during 1992–1999, 2000–2007, and 2008–2015 are mapped in Figures 5.2.1 through 5.2.3. Reductions in female mortality from 1992–1999 to 2008–2015 also occurred mostly in CDs in the southern half of the country (Figure 5.2.4). Increases in female mortality over time varied geographically across CDs.



Figure 5.2.1 Premature mortality per 100,000 females by census divisions across Canada in 1992–1999.





Figure 5.2.2 Premature mortality per 100,000 females by census divisions across Canada in 2000–2007.



Figure 5.2.3 Premature mortality per 100,000 females by census divisions across Canada in 2008–2015.





Figure 5.2.4 Percent change in premature mortality per 100,000 females between 1992–1999 and 2008–2015, per census division.

WITHIN PROVINCE VARIATIONS

Within provinces, the range of adult premature mortality rates varied greatly between census divisions. The absolute and relative differences between the maximum and minimum rates were calculated for the 2008–2015 era.

Among provinces consisting of several CDs, i.e. those outside of PEI and the Territories, the widest variations in male mortality between CDs were found in AB, ON, and QC, where the highest rates were more than three times the lowest rates. The smallest amount of variation between CDs was in NL, where the highest male mortality rate was 75% greater than the lowest.

The greatest geographic variations in female mortality rates were also in AB, ON, and QC, at similar magnitudes as that of males. The smallest variation was in SK, where the maximum mortality was 68% higher than the minimum.



6 PREMATURE MORTALITY BY SOCIOECONOMIC STATUS

MEASURES OF AREA-BASED SOCIOECONOMIC STATUS

Socioeconomic status (SES) was assessed using area-level household income quintiles captured at the Dissemination Area (DA) level; assessment was limited to eras 2000–2007 and 2008–2015 due to data availability. Dissemination areas, which are the smallest geographic unit at which Canadian census data are released, have typical population sizes between 400 and 700 individuals. Based on household income self-reported during the census, Statistics Canada ranks all DAs across Canada into five equal-sized groups, or quintiles, in order of ascending average household income. The quintiles are adjusted for the metropolitan area or region in which the DA is located. We assigned each individual death to an income quintile according to the residential postal code at time of death.

Two summary measures of socioeconomic inequality, the slope index of inequality (SII) and relative index of inequality (RII), were also estimated per province and era, to examine inequalities in mortality between area-based SES and to capture trends over time. The SII is an absolute difference between individuals in the bottom versus top socioeconomic positions, whereas the RII is a relative ratio between the two (20). Details of how these measures were estimated can be found in the Technical Appendix.

MORTALITY RATES

Adult premature mortality rates increased with lower area-level income, and vice-versa. Overall, mortality rates declined over time between 2000–2007 and 2008–2015; however, trends differed across provinces and territories and between income quintiles, both in terms of magnitude and direction.

Among Canadian provinces, the highest male mortality rates were found among those in the bottom income quintiles in MB and SK. The lowest rates were found in males in the top income quintiles in AB and ON. These rankings held for both eras.

Among Canadian provinces, the highest female mortality rates were found among those in the bottom income quintiles in MB and SK. The lowest rates were found in females in the top income quintiles in AB and BC. These rankings held for both eras. Additionally, in NL, the mortality among females in the bottom income quintile grew between the two eras from 3043 to 3661 deaths per 100,000, nearing that of SK (3970 per 100,000) by 2008–2015.

In 2008–2015, the differences in mortality rates between males of the bottom versus top income quintiles were 3303 deaths per 100,000 in MB, and 3008 per 100,000 in SK. The differences in mortality rates between females of the bottom versus top income quintiles were 2150 deaths per 100,000 in MB, and 2015 per 100,000 in SK.

MORTALITY BY SES, ACROSS SEXES

While the highest premature mortality rates were usually found in males of the lowest income quintile, and lowest in females of the top income quintile, exceptions were seen when comparing mortality by SES across sexes.



In 2000–2007, females of the bottom income quintile in MB had higher mortality than males in the top income quintile in all other provinces. Similarly, the mortality rate of females in the bottom quintile in SK exceeded that of the males in the top quintiles in all other provinces, except for NL. Males in the top income quintile in AB had lower mortality than females in the bottom quintiles of the rest of the country. In AB, BC, MB, SK, and QC, female mortality in the bottom income quintile exceeded that of males in the top income quintile.

Among provinces in 2008–2015, within the top income quintile, female premature mortality in NS was higher than that of males in AB. Females of the bottom income quintile in MB, NL, and SK had higher mortality than males in the top income quintiles in all other provinces. In addition to MB, NL, and SK, female mortality in the bottom income quintile exceeded that of males in the top income quintile in AB, BC, NB, NS, ON, and QC.

INDICES OF SOCIOECONOMIC INEQUALITY

The slope and relative indices of inequality were calculated with linear regression of provincial rates on quintile rank (19). The SII is interpreted as the predicted absolute difference between the top and bottom socioeconomic positions, in units of deaths per 100,000. For example, an SII value of 349 deaths per 100,000 can be interpreted to mean that the mortality rate at the lowest socioeconomic position in a population is 349 deaths per 100,000 higher than the mortality rate at the highest socioeconomic position in that same population. Positive SII values mean that mortality among those residing in low-income areas is greater than mortality of those in high-income areas, indicating socioeconomic inequality. The RII is the predicted relative difference, which is a ratio of rates between the quintiles. RII values greater than 1.0 indicate that mortality of those residing in low-income areas is greater than the mortality of those residing in low-income areas is greater than socioeconomic areas. An RII value of 3.49 would indicate that the mortality rate at the lowest socioeconomic position is about three and a half times the rate of those in the highest socioeconomic position.

Figures 6.1.1 and 6.2.1 present the male and female SII and RII values for both eras. The provinces/territories are arranged in order of increasing SII in the latest era (2008–2015). SES differences in both male and female mortality were largest for MB and SK using these measures of inequality in both eras. Male mortality in the territories and NL had the smallest SES differences in 2000–2007, but grew substantially in 2008–2015. The growth in SES differences over time also applied to female mortality in NL and NT. Other notable provinces were PEI and NB, where SES inequality noticeably widened over time for females when assessed with both SII and RII. For males, the extent of socioeconomic inequality was small in NB.

The SII may increase over time due to declining mortality in the top income quintile accompanied with either increasing or slightly decreasing mortality in the bottom quintile. This scenario is seen in NL, where premature mortality among males and females in the bottom income quintile increased, while that of the top quintile declined. In SK, female mortality for the lowest area-level income quintile increased marginally by 98 deaths per 100,000, but dropped by 272 deaths per 100,000 for females in the top area-level income quintile.





Figure 6.1.1 Slope (SII) and Relative index of inequality (RII) of male premature mortality, era 2 (2000–2007) and era 3 (2008–2015). Provinces/territories on horizontal axis ordered by increasing SII in era 3.



Figure 6.2.1 Slope (SII) and Relative index of inequality (RII) of female premature mortality, era 2 (2000–2007) and era 3 (2008–2015). Provinces/territories on horizontal axis ordered by increasing SII in era 3.



Most regions of the country also saw increases in RII over time, which were greatest in SK, NL, and ON for male mortality, and SK, NL, and NB for female mortality. Along with divergent directions of rates over time, the widening of RII values can also be attributable to a greater proportional reduction of the mortality in the top income quintile compared to that of the bottom quintile. For example, in Figure 6.1.2, the downward slope in Saskatchewan's male mortality rate is steeper for the top income quintile (Q1). In other words, the mortality rate of Q1 did not reduce sufficiently to close the income disparity as measured with RII.



Figure 6.1.2 Premature mortality per 100,000 males for the lowest (Q1) and highest (Q5) area-level income quintiles in SK and NL.



Figure 6.2.2 Premature mortality per 100,000 females for the lowest (Q1) and highest (Q5) area-level income quintiles in SK and NL.



7 CONCLUSIONS

KEY TRENDS

Adult premature mortality declined overall between 1992–1999 and 2008–2015 across Canada. Premature mortality trends differed by geography, age, and across socioeconomic status. Mortality rates also differed between males and females.

Geography

In the most recent era (2008–2015), NL, NS and NU had the highest premature mortality rates for both adult males and females, while the lowest rates were found in AB, BC, and ON. Over time, reductions in male mortality were larger in Central Canada (ON, QC) compared to the rest of the country. Female mortality also declined in most parts of the country, especially in BC and ON. However, female mortality increased by 14% in NL between 1992–1999 and 2008–2015.

Examining premature mortality at finer levels of geography revealed further between- and withinprovince variations. Across census divisions in 2008–2015, high male mortality rates were concentrated in MB and parts of ON. For females, the highest CD-level mortality rates were in MB and QC, and the lowest in AB, BC, and ON. The widest range of mortality rates were found in AB, ON, and QC for both sexes. The narrowest range was found in NL for male mortality, and in SK for female mortality.

Age

Adult premature mortality rates increased with age. The age distribution of premature deaths varied across provinces. In 2008–2015, male mortality rates were lowest in ON and QC for those under age 55, and BC for age groups 55–64 and 65–74. PEI also had low mortality among males under 45 years old. Male mortality was high in the Territories for all ages, in MB and SK for those under 55, and in NL for those 55 years and older. Adult female premature mortality was low in BC and ON across all ages. QC also had low rates for the 35–44 and 65–74 age groups, PEI for those 18–34, and AB for those 55–64 years of age. Female mortality was highest in the Territories for all ages, in MB and SK for those under 55, in MB for ages 55–64, and in NL for ages 65–74.

Reductions in premature mortality rates between 1992–1999 and 2008–2015 were greater in older age groups. Decreases in male mortality rates were substantial in QC among those 18–34 and 55 and older, in BC among those under 45, in PEI among those 45–54 and 55–64 years of age, and in NL among those 65–74 years of age. In contrast, mortality rose by 21% between 1992–1999 and 2008–2015 in SK for males aged 35–44 years, and by 2–3% in NL in those under 45 years of age. Female premature mortality declined between 1992–1999 and 2008–2015 in PEI for the 18–34 and 55–64 age groups, in QC for age groups 35–44 and 45–54, in ON for age groups 45–54 and 65–74, and in NL for those aged 55–64 years. However, mortality increased among females 18–34 and 35–44 years of age in NL, MB, and SK, and those 45–54 years of age in SK for the same period.

Cause of Death

In 2008–2015, external causes accounted for most premature male deaths, close to half of female deaths in the 18–34 age group. Among ages 35–44, external causes (such as injury and poisoning) were the main contributor to male deaths, and cancer to female deaths. In the 45–54 age group, the largest proportions of male deaths were split between cardiovascular/circulatory diseases and cancer; female



deaths were mostly attributable to cancer. Among ages 55 and older, deaths in both sexes were mostly caused by cancer.

Distributions by the five broad categories of underlying causes of death changed slightly over time. A larger proportion of deaths were attributed to external causes in 2008–2015 compared to 1992–1999 for those under 55 years of age, and proportions due to circulatory diseases reduced in those 55 and older. During the same period, the proportion of female deaths in ages 18–34 due to external causes increased, while the proportion due to circulatory diseases decreased in those 55 and older.

In 2008–2015, causes of premature death varied between provinces and territories. Relatively larger proportions of male deaths by external causes in those under 55 years old were found in AB, and by cardiovascular/circulatory diseases in ages 35–54 in NL. A greater proportion of female deaths in the 18–34 and 35–44 age groups were attributed to external causes in AB and MB, compared to the rest of the country. Cardiovascular/circulatory deaths in females 35–44 years of age were proportionately larger in the Atlantic region, and cancer deaths in age groups 45–54 and 55–64 in QC.

Socioeconomic Status

Adult premature mortality increased with lower levels of socioeconomic status, such that low-income areas experienced the highest premature mortality rates for males and females. As of 2008–2015, males and females in the bottom income quintile in MB and SK had the highest mortality rates. The lowest rates were found in the top income quintiles in AB and ON for male mortality, and in the top income quintiles in AB and BC for female mortality.

Although mortality has decreased over time across Canada, trends varied between income quintiles, and differed by province or territory. Inequalities measured by SII and RII were largest in MB and SK across both eras. The smallest socioeconomic inequalities were seen in the Atlantic provinces for 2000–2007, with gaps widening by 2008–2015. These patterns by SES applied to both male and female premature mortality rates.

Despite generally lower mortality in females compared to males, stratification by income quintile showed exceptions to this trend. For example, in 2008–2015, females in the bottom income quintile in MB, NL, and SK had premature mortality rates higher than that of males in the top income quintile in the other provinces.

STRENGTHS

This report comprehensively documents premature mortality in Canada from 1992 to 2015. Premature mortality is a well-established metric to evaluate health system performance. The examination of adult premature mortality rates at the provincial, census division, and socioeconomic levels, and by age groups and causes of death provides context for public health evaluation and planning. Since each province/territory is responsible for its own health systems operation, and each has its own set of regional health authorities, stratification at the provincial/territorial and census division levels standardizes comparisons of mortality across the country. Further, the use of census division units allows for linkage to other area-based sociodemographic variables, data on which are collected at regular census cycles.

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Examining premature mortality by area-based income quintiles is important for identification of socioeconomic inequalities. The income gradient and its inequalities are well-known predictors of population health and mortality (21-25). These analyses used area-adjusted income quintiles such that the DAs of residence were ranked locally within the Census metropolitan area, to better reflect the effects of socioeconomic position in each province. The calculation of the two indices of inequality, SII and RII allows for a regression-based summary of both absolute and relative inequalities in mortality.

In addition, the data used was from the Canadian Vital Statistics Deaths Database (CVSD), which captures all deaths registered in Canada between 1992 and 2015. Use of these data enabled direct calculations of mortality rates capturing all premature mortality in the country.

LIMITATIONS

Examining mortality at finer levels of geography resulted in low frequencies, which were unstable or supressed due to small numbers. However, this only applied to a few categories in the Territories and PEI when stratified by age groups and by causes of death, and did not alter the interpretation of results. The three territories were aggregated into "the Territories" for age- and cause-specific mortality, which at the trade-off of masking detailed information, stabilized mortality rates with larger sample sizes. Assignment of cause of death is also based on the underlying condition to which the death is mostly attributable, which is subject to coding practices of individual health care providers and medical examiners, and may vary by jurisdiction.

Data quality for the Territories was variable, further compounded with the separation of Nunavut from Northwest Territories in 1999, making trends over time difficult to report. Although we found high mortality rates in these regions, these findings should be taken with caution given inconsistencies in data quality over time.

In stratifying mortality by socioeconomic status, area-level income was linked to death records by dissemination area (DA) of residence, as the CVSD does not contain individual-level income. Literature has shown that area-level income does not reflect measure of individual income (26). Further, income is only one way of measuring SES (24, 27). For example, the Canadian Marginalization Index was developed and widely used to study health outcomes along the socioeconomic gradient (28). Specifically, its material deprivation index, a composite measure of income, education, unemployment rates, government transfer payments, and lone-family household status at the neighbourhood level, was previously employed by our lab to examine SES differences in premature mortality in Ontario (1, 2, 28). While we considered using this variable, the deprivation index suffered from more missing data than income alone, as the former encompasses dimensions additional to the latter. Availability of data for the deprivation index data for the three territories was also limited to the 2008–2015 era. We used area-level income quintile as it was the most stable measure of socioeconomic status available for our study population.



DISCUSSION

The overall reduction of adult premature mortality in Canada has been promising, with declines in the past three decades. However, stratifying mortality rates by various levels of geography, age, causes of death, and socioeconomic status provides further insights into patterns of premature death across the country.

Geographic differences

As of 2015, substantial differences in premature mortality rates persist between and within provinces and territories. The downward trend of mortality rates over time has not been uniform across geographic areas, as some have experienced increases in mortality.

At the census division level, improvements in male and female mortality mostly occurred in the southern half of the country. Mortality rates at these levels of geography reveal cross- and within-province variations.

Age and socioeconomic differences

We observed that premature mortality generally increased with age, though declines in rates over time were greater in the older age groups. Changes in mortality could have been influenced by sociodemographic changes, public health interventions, health promotion strategies, and medical treatment. There are differences between provinces in their age structures, socioeconomic distributions, and health systems, which have also varied over time. For example, provinces can differ in the amount of technological, human, and pharmaceutical resources available to its residents (29).

We noted increases in age-specific mortality rates in males between 35 and 54 and females under 55 years of age in certain provinces. Premature deaths in these age groups tended to be attributable to external and other causes. Although these findings warrant further indication, they may be a signal of the recently described term "deaths of despair", which has been used to describe deaths caused by suicides, alcohol poisoning, and drug overdose, especially in the middle age groups. These deaths can be considered as consequences of socioeconomic conditions and patterns in labour force participation (30, 31).

Striking and persistent disparities exist in premature mortality in the high versus low area-based income groups, and these differences have widened in many areas of the country, including in regions with small disparities in 2000-2007. Both absolute and relative indices, i.e. SII and RII, are important measures to consider, as percent reductions or increases may not translate to the same amount of deaths per 100 thousand population across provinces. These findings are important in contributing to a currently lacking body of research on SES inequalities in mortality across Europe and North America (32). Much of the existing work in this area was done by Mackenbach et al. in the European setting, using education level and occupation class to measure SES (19, 24, 27, 33). They found that over time, there were greater relative inequalities, and reductions in absolute inequalities due to improvements in premature mortality among low SES populations (27). In our examination of Canadian regions, we found both increased relative inequalities and increased or stagnant absolute inequalities.



Sex differences

All presentations and discussions of mortality in this report were stratified by sex. The reductions in premature mortality rates between 1992–1999 and 2008–2015 were found to be greater in males than females (-21% vs. -13%); males also had higher rates in 1992–1999. Sex differences in mortality are well-established. Studies examining trends in developed countries typically find males to have higher mortality than females (34-37). These findings are expected as sex differences exist for chronic disease risk factors and injury rates (38). Related social, behavioural, and biological risk factors, such as smoking and health care utilization also differ by sex (34, 36, 39, 40). In addition to sex, mortality also differs by gender, which could be influenced by social and behavioural factors (41, 42). However, we were not able to describe mortality rates by gender identity due to lack of access to such information.

Currently, in Canada, males have lower average life expectancies than females, at 79.9 and 84.0 years, respectively (43). National trends observed over the past few decades find that female life expectancy is increasing, but at a slower pace than that of males, and that the survival gap is projected to narrow (39, 44). This report found female mortality trends over time to be less consistent than that of males, across age groups and provinces. These results are consistent with studies that partly relate life expectancy extensions with improvements in cardiovascular/circulatory disease survival among males, and smaller amounts of reductions in female mortality, especially in the older age groups (44). Previous work in Ontario, which holds the largest population in Canada, has found similar trends in decreasing differences in premature mortality by sex (45).

Stratified by socioeconomic status, time trends in premature mortality appeared to be less stable for females than males. In 2000–2007, RII values for female mortality were relatively lower across all provinces. By 2008–2015, female mortality RII values grew to be comparable or higher than that of males, particularly in BC and the Atlantic region. This increase resulted in greater differences in RII between the two eras for female than male mortality in most provinces. Thus, the relative income inequalities in the latest era are similarly unfavourable for both sexes.

NEXT STEPS

The reporting of patterns in adult premature mortality is valuable for assessing overall population health and prevention and planning in the health system. Specifically, premature deaths are largely considered to be avoidable through public health prevention, addressing the social determinants of health, environmental prevention measures, and early and effective medical treatment (46, 47).

Though the overall trend over time shows a decrease in mortality rates, there are variations at multiple geographic, sex-specific, age-specific, and cause-specific levels. Evidence also exists for inverse associations between area-based SES and premature mortality, with gaps between the top and bottom income quintiles widening over time. This descriptive report provides information on the state of premature mortality that can inform regional, provincial, and national efforts aimed at reducing inequities, and ensuring health for all segments of the population across Canada.



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TECHNICAL APPENDIX

Death Numerators

All numerators were from the Canadian Vital Statistics Deaths Database (CVSD). Included deaths were those aged between 18 and 74 years at the time of death between 1992 and 2015. Deaths which occurred outside of Canada were excluded. Individuals without a known place of residence within Canada were excluded. Deaths with missing census division or income information were omitted from their respective sections in the report. The final sample size was 2,175,110 deaths.

Population Denominators

Denominators were mid-year population counts at the respective age, sex, and geographic stratifications, between ages 18 and 74. Specifically, provincial, census division (CD), and dissemination area (DA) level counts were from the Canadian Socio-Economic Information Management System (CANSIM), publicly accessible via the Statistics Canada website. Annual rates used populations for each year of death as denominators. Era rates were calculated as the total number of deaths in the era (e.g. 1992–1999), divided by the mid-era population (e.g. the 1995 population). The mid-era years used were 1995, 2003 and 2011. Although population counts at the CD level were available for individual years, division boundaries can be revised at each census cycle. Thus, CD boundary considerations were as follows: 2001 boundaries for deaths occurring in 1992–1995, 2006 boundaries for deaths in 1996–2005 deaths, and 2016 boundaries for deaths in 2006–2015. When new CDs were created, we assigned the earliest available population count. Boundaries from the 2011 cycle were not used due to the elimination of the long-form census, leading to data quality concerns.

Stratifications

Causes of Death

Five broad categories, commonly used to classify distributions of underlying causes of death were applied to the premature mortality rates presented this report: diseases of the cardiovascular and circulatory system, cancer, diseases of the respiratory system, external causes, and other causes. Deaths which occurred in 1999 and earlier were coded with ICD-9 codes, and those which occurred in 2000 and onwards were coded with ICD-10 codes. A list of these codes is as follows:

Appendix Table 3.1. Underlying Causes of Death by ICD Codes (International Statistical Classification of Diseases and Related Health Problems)

	ICD 9 (Deaths in 1992–1999)	ICD 10 (Deaths in 2000-2015)
Diseases of the cardiovascular and	390-459	100–199
circulatory system		
Neoplasms (cancer)	140-239	C00-D48
Diseases of the respiratory system	460-519	J00–J99
External causes (all types)	800-999.9	U50.9
		V01-Y89
Other	All others	All others



Tabulating deaths per age group and cause of death resulted in sample sizes that were too low to be published. To mitigate confidentiality issues, Yukon, Northwest Territories, and Nunavut were first grouped together as the Territories. Then, deaths in certain age groups in the Territories and in PEI were reassigned from one of the four specific causes to the "other causes" category.

Socioeconomic Status

Calculation of mortality rates was limited to the last two eras (2000–2007 and 2008–2015) due to data availability on the socioeconomic status (SES) measure, which was Quintile of Annual Income per Person Equivalent (QAIPPE). These pieces of information on income at the DA-level were adjusted by household size, and ranked into quintiles within each census metropolitan area (CMA). Income quintiles were found in the QAIPPE variable in the Postal Code Conversion File Plus (PCCF+) datasets associated with each census cycle, available to those with institutional access. Deaths in 2000–2008 were linked with PCCF+ version 5E, 2009 with version 5J3, 2010 with version 5K0, and 2011–2015 with version 6D. Documentation of the development of QAIPPE can be found elsewhere (48). The income quintiles were assigned to individual CVSD records by postal code, or if unavailable, DA of residence. Individual deaths were totalled within each income quintile for the numerators.

Denominators used were total population sizes of all DAs in each quintile. Since 2003 was not a census year and the 2011 Census was subject to data concerns, DA-level population counts were not directly available. Approximate population sizes were produced by applying the provincial growth percentage from the preceding census year, i.e., 1996, 2001, and 2006, respectively, to all quintiles, among those aged 18–74 years in the respective sexes.

To examine income disparities in premature mortality, the slope index of inequality (SII) and relative index of inequality (RII) were calculated with provincial-level rates in the latest two eras. The five quintiles were ranked in descending order of highest to lowest income (Q₅ to Q₁), then assigned equidistant values between 0 and 1, i.e., 0.1, 0.3, 0.5, 0.7, and 0.9. The mortality rates in each quintile were linearly regressed against the rank values, such that the equation of the line is $y = \alpha + \beta * x$, where y= rate and x= rank. Using the slope (β) and intercept (α) of each regression line per province and era, SII was calculated as y(1) - y(0), or y_{Q_1} - y_{Q_5} , and RII as y(1)/y(0), or y_{Q_1} - y_{Q_5} .

Data Access and Confidentiality

All data were accessed securely at and exported from Statistic Canada's Research Data Centre in Toronto, Ontario. Frequencies and rates calculated from death counts of 1 through 4 were omitted to preserve confidentiality. Mortality rates by provinces and by income quintiles were calculated from additive conditionally (AC) rounded death counts using base 5. Census division rates were presented as randomly rounded rates (per 100k individuals) using base 5. All stratifications by age were calculated from AC rounded deaths using base 10. Along with AC rounding, the previously mentioned strategies to handle small sample sizes when stratified by age groups by causes of death may have resulted in zero deaths in PEI and the Territories in certain categories where deaths actually existed, i.e., false zeroes. Population denominators were not rounded.



DATA APPENDIX

PREMATURE MORTALITY BY PROVINCES AND TERRITORIES

Appendix Table 1.1. Names and abbreviations of Canadian provinces and territories

Province/Territory	Abbreviation
Newfoundland and Labrador	NL
Prince Edward Island	PEI
Nova Scotia	NS
New Brunswick	NB
Quebec	QC
Ontario	ON
Manitoba	MB
Saskatchewan	SK
Alberta	AB
British Columbia	BC
Yukon	YT
Northwest Territories	NT
Nunavut	NU



Male Mortality

Appendix Table 1.2.1. Annual premature mortality per 100,000 males

Region	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NL	569	579	594	565	560	589	572	563	603	584	576	583	573	606	617	585	569	590	566	567	610	603	632	637
PEI	702	647	639	678	699	543	610	552	647	611	553	546	529	525	565	555	601	584	514	515	540	611	503	512
NS	658	633	638	600	611	590	593	568	572	554	552	544	573	571	575	565	554	556	549	539	550	580	587	617
NB	617	591	594	632	581	570	578	563	549	552	524	553	516	511	508	535	544	528	520	532	534	524	545	581
QC	609	629	613	616	599	592	575	573	542	528	524	514	492	495	465	477	465	454	446	446	447	445	450	457
ON	559	568	563	554	541	519	502	499	481	462	455	457	440	429	421	427	420	416	413	411	409	414	420	416
MB	619	618	599	605	559	548	568	568	592	548	526	529	531	507	513	529	536	511	492	506	505	516	521	507
SK	574	602	599	614	588	562	583	589	551	545	557	554	551	537	530	523	549	524	523	498	489	492	512	514
AB	481	477	479	474	479	444	453	440	428	434	415	414	412	408	395	394	401	385	374	380	382	388	392	407
BC	566	572	545	534	539	510	497	484	453	460	459	449	462	462	449	451	447	428	414	417	415	426	434	435
YT	453	534	514	591	521	470	523	575	668	538	574	517	506	621	528	599	546	572	629	575	597	592	552	546
NT	n/a	391	523	404	488	477	409	377	499	497	437	467	493	458	454	510	447							
NU	n/a	730	652	632	565	603	537	577	560	594	529	563	592	583	662	739	603							
NT+NU	536	505	540	391	543	496	567	339	n/a															
Canada	573	582	572	567	556	536	526	520	501	488	481	478	467	463	449	454	450	440	432	432	432	437	443	446



Region	1992-1999	2000-2007	2008-2015									
NL	574	591	597									
PEI	633	566	547									
NS	611	563	566									
NB	590	531	539									
QC	600	504	451									
ON	538	446	415									
MB	585	534	512									
SK	589	543	512									
AB	465	412	389									
BC	529	456	427									
YT	522	569	576									
NT	n/a	446	470									
NU	n/a	604	610									
NT+NU	512	n/a	n/a									
Canada	553	472	439									

Appendix Table 1.2.2. Premature mortality per 100,000 mid-era male population*

*Mid-era population sizes were those in years 1995, 2003, and 2011, respectively



Region	1992 vs. 1999	2000 vs. 2008	1992 vs. 2015	Era 1 vs. 3*	Era 1 vs. 2*	Era 2 vs. 3*
NL	-1%	-6%	12%	4%	3%	1%
PEI	-21%	-7%	-27%	-14%	-11%	-3%
NS	-14%	-3%	-6%	-7%	-8%	1%
NB	-9%	-1%	-6%	-9%	-10%	1%
QC	-6%	-14%	-25%	-25%	-16%	-11%
ON	-11%	-13%	-25%	-23%	-17%	-7%
MB	-8%	-9%	-18%	-13%	-9%	-4%
SK	3%	0%	-10%	-13%	-8%	-6%
AB	-8%	-6%	-15%	-16%	-12%	-6%
BC	-14%	-1%	-23%	-19%	-14%	-6%
YT	27%	-18%	20%	10%	9%	1%
NT	n/a	27%	n/a	n/a	n/a	5%
NU	n/a	-19%	n/a	n/a	n/a	1%
NT+NU	-37%	n/a	n/a	n/a	n/a	n/a
Canada	-13%	-10%	-22%	-21%	-15%	-7%

Appendix Table 1.2.3. Percent change in male prema	ature mortality over time
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*Era 1: 1992–1999, Era 2: 2000–2007, Era 3: 2008–2015



Female Mortality

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Region	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NL	312	299	332	305	320	355	344	340	356	337	339	351	338	354	360	365	342	338	335	355	379	403	402	415
PEI	350	368	352	360	356	267	372	347	334	290	350	367	334	341	320	289	354	350	296	338	382	307	344	324
NS	381	372	381	363	369	377	383	350	348	343	346	338	335	345	328	357	355	336	349	371	371	369	366	392
NB	335	345	364	327	349	329	335	317	342	315	325	318	315	312	328	321	327	329	327	304	334	341	369	383
QC	342	351	350	352	351	345	340	342	324	331	329	317	317	314	309	309	310	307	301	307	305	305	312	318
ON	333	339	341	337	330	320	317	312	306	300	294	296	283	285	275	276	274	271	269	265	267	267	274	281
MB	364	374	382	391	368	365	365	361	360	340	361	353	343	355	337	349	343	354	329	329	337	332	347	349
SK	330	354	342	346	344	341	358	340	365	324	332	337	340	327	345	329	343	332	342	336	324	331	335	350
AB	285	301	294	286	304	288	270	275	275	268	271	270	262	266	258	265	262	254	241	249	256	259	261	258
BC	319	337	324	313	305	299	306	285	281	279	282	277	284	280	273	281	282	270	269	267	264	267	265	273
YT	346	196	197	386	187	230	234	281	329	280	229	268	349	215	380	334	246	399	310	302	368	400	320	351
NT	n/a	270	266	259	289	247	210	315	275	272	270	266	296	359	258	288	285							
NU	n/a	543	461	444	308	299	291	340	276	489	526	307	348	339	427	372	367							
NT+NU	250	272	210	282	253	302	302	224	n/a															
Canada	332	341	340	336	333	325	323	317	311	306	306	302	297	297	290	292	292	287	282	283	285	286	291	298



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Region	1992-1999	2000-2007	2008-2015
NL	326	350	371
PEI	346	328	337
NS	372	342	364
NB	338	322	339
QC	347	318	308
ON	328	289	271
MB	371	350	340
SK	344	337	337
AB	288	267	255
BC	310	280	270
YT	257	299	338
NT	n/a	266	287
NU	n/a	365	395
NT+NU	275	n/a	n/a
Canada	331	300	288

Appendix Table 1.3.2. Premature mortality per 100,000 mid-era female population

Notes: mid-era population sizes were those in years 1995, 2003, and 2011, respectively



Region	1992 vs. 1999	2000 vs. 2008	1992 vs. 2015	Era 1 vs. 3*	Era 1 vs. 2*	Era 2 vs. 3*
NL	9%	-4%	33%	14%	8%	6%
PEI	-1%	6%	-7%	-3%	-5%	3%
NS	-8%	2%	3%	-2%	-8%	6%
NB	-5%	-5%	14%	1%	-5%	5%
QC	0%	-4%	-7%	-11%	-8%	-3%
ON	-6%	-11%	-16%	-18%	-12%	-6%
MB	-1%	-5%	-4%	-8%	-6%	-3%
SK	3%	-6%	6%	-2%	-2%	0%
AB	-4%	-5%	-10%	-11%	-7%	-4%
BC	-11%	0%	-15%	-13%	-10%	-4%
YT	-19%	-25%	1%	32%	16%	13%
NT	n/a	1%	n/a	n/a	n/a	8%
NU	n/a	-10%	n/a	n/a	n/a	8%
NT+NU	-11%	n/a	n/a	n/a	n/a	n/a
Canada	-6%	-6%	-10%	-13%	-9%	-4%

Appendix Table 1.3.3. Percent change in female premature mortality over time

*Era 1: 1992–1999, Era 2: 2000–2007, Era 3: 2008–2015



PREMATURE MORTALITY BY AGE

Male Mortality

Age Group (years)	Province	1992–1999 (Deaths/100k)	2000–2007 (Deaths/100k)	2008–2015 (Deaths/100k)	Absolute change (Era 3 vs. 1)	Absolute Reduction Rank	Percent Change (Era 3 vs. 1)	Relative Reduction Rank
	NL	89.6	98.2	92.0	2.4	11	3%	11
	PEI	113.9	101.2	77.4	-36.5	3	-32%	3
	NS	102.7	82.4	83.8	-18.9	8	-18%	7
	NB	114.9	100.6	91.8	-23.1	7	-20%	6
	QC	121.2	85.3	64.8	-56.4	1	-47%	1
10.04	ON	89.0	69.6	64.5	-24.5	5	-28%	4
18-34	MB	122.4	113.3	107.0	-15.4	9	-13%	8
	SK	126.1	123.2	122.7	-3.4	10	-3%	10
	AB	123.9	99.6	97.6	-26.3	4	-21%	5
	BC	136.9	96.0	82.2	-54.7	2	-40%	2
	Territories	253.8	248.7	229.6	-24.2	6	-10%	9
	Canada	110.6	85.6	76.7	-33.9		-31%	
	NL	158.6	146.0	158.5	-0.1	10	0%	10
	PEI	182.6	195.4	125.8	-56.8	3	-31%	4
	NS	182.4	166.5	145.5	-36.9	5	-20%	5
	NB	183.8	157.6	159.5	-24.3	7	-13%	7
35-44	QC	192.2	149.3	114.7	-77.5	2	-40%	1
	ON	172.6	131.6	116.5	-56.1	4	-33%	3
	MB	173.4	168.2	167.0	-6.4	9	-4%	9
	SK	168.5	185.5	203.5	35.0	11	21%	11
	AB	176.6	164.6	141.9	-34.7	6	-20%	6

Appendix Table 2.1 Male mortality rates in each age group, per era, and changes from era 1 (1992–1999) vs. era 3 (2008–2015)



	BC	216.0	165.4	135.5	-80.5	1	-37%	2
	Territories	279.2	258.7	261.4	-17.8	8	-6%	8
	Canada	184.3	148.8	128.7	-55.6		-30%	
	NL	407.2	378.9	358.0	-49.2	7	-12%	7
	PEI	436.0	361.5	331.7	-104.3	2	-24%	2
	NS	438.9	376.8	362.8	-76.1	4	-17%	5
	NB	410.2	348.3	343.1	-67.1	6	-16%	6
	QC	419.5	348.0	287.7	-131.8	1	-31%	1
45 54	ON	369.7	332.3	292.1	-77.6	3	-21%	3
45-54	MB	400.2	392.1	370.4	-29.8	9	-7%	9
	SK	391.9	372.5	381.2	-10.7	10	-3%	10
	AB	362.9	343.9	325.9	-37.0	8	-10%	8
	BC	380.8	345.2	304.8	-76.0	5	-20%	4
	Territories	464.1	435.9	465.9	1.8	11	0%	11
	Canada	389.9	345.4	306.6	-83.3		-21%	
	NL	1225.1	1023.4	890.0	-335.1	5	-27%	6
	PEI	1286.3	941.1	829.8	-456.5	2	-35%	2
	NS	1184.0	986.9	860.5	-323.5	7	-27%	7
	NB	1184.4	918.2	816.9	-367.5	4	-31%	3
	QC	1192.8	907.3	733.6	-459.2	1	-38%	1
FF 64	ON	1071.3	845.4	739.5	-331.8	6	-31%	4
55-04	MB	1146.5	976.2	877.7	-268.8	8	-23%	10
	SK	1103.3	945.7	845.0	-258.3	10	-23%	11
	AB	1012.0	825.3	748.1	-263.9	9	-26%	9
	BC	969.7	791.8	712.4	-257.3	11	-27%	8
	Territories	1305.4	1054.0	932.9	-372.5	3	-29%	5
	Canada	1098.6	870.4	752.4	-346.2		-32%	
65 74	NL	3443.2	2899.3	2232.7	-1210.5	2	-35%	6
05-74	PEI	3201.0	2590.4	2069.9	-1131.1	5	-35%	5



NS	3298.8	2645.7	2157.1	-1141.7	4	-35%	7
NB	3193.8	2585.0	1991.4	-1202.4	3	-38%	3
QC	3170.6	2442.4	1862.0	-1308.6	1	-41%	1
ON	2845.8	2257.8	1757.3	-1088.5	6	-38%	2
MB	2986.5	2609.7	2147.1	-839.4	9	-28%	9
SK	2772.1	2491.6	2108.0	-664.1	11	-24%	11
AB	2639.4	2218.1	1831.5	-807.9	10	-31%	8
BC	2511.8	2008.2	1620.1	-891.7	8	-36%	4
Territories	3750.3	3404.4	2722.1	-1028.2	7	-27%	10
Canada	2902.3	2319.9	1824.7	-1077.6		-37%	

*Denominators for mortality rates were mid-era population sizes in years 1995, 2003, and 2011, respectively. Rankings were in order of greatest to least amount of reduction in mortality between eras.



Female Mortality

Age Group (years)	Province	1992-1999 (Deaths/100k)	2000–2007 (Deaths/100k)	2008-2015 (Deaths/100k)	Absolute change (Era 3 vs. 1)	Absolute Reduction Rank	Percent Change (Era 3 vs. 1)	Relative Reduction Rank
	NL	36.3	41.0	42.8	6.5	8	18%	8
	PEI	38.0	33.3	25.5	-12.5	1	-33%	1
	NS	39.2	38.5	35.4	-3.8	6	-10%	6
	NB	40.4	37.7	41.3	0.9	7	2%	7
	QC	41.9	33.9	29.9	-12.0	2	-29%	2
10.24	ON	35.0	31.2	30.5	-4.5	5	-13%	4
18-34	MB	47.9	52.7	63.6	15.7	10	33%	10
	SK	49.3	59.9	62.0	12.7	9	26%	9
	AB	48.1	43.1	42.3	-5.8	4	-12%	5
	BC	47.9	40.0	37.7	-10.2	3	-21%	3
	Territories	79.2	82.5	123.1	43.9	11	55%	11
	Canada	41.0	36.6	35.8	-5.2		-13%	
	NL	80.8	84.8	100.7	19.9	10	25%	10
	PEI	83.4	94.8	93.5	10.1	8	12%	8
	NS	101.1	92.9	85.6	-15.5	6	-15%	6
	NB	100.7	83.8	80.8	-19.9	4	-20%	3
	QC	103.8	87.4	70.1	-33.7	1	-32%	1
25 44	ON	89.7	81.9	73.1	-16.6	5	-19%	5
35-44	MB	106.0	117.2	113.8	7.8	7	7%	7
	SK	110.9	109.1	130.7	19.8	9	18%	9
	AB	107.1	98.7	87.1	-20.0	3	-19%	4
	BC	100.7	86.9	77.3	-23.4	2	-23%	2
	Territories	112.9	134.8	156.6	43.7	11	39%	11
	Canada	98.1	88.1	78.9	-19.2		-20%	

Appendix Table 2.2 Female mortality rates in each age group, per era, and changes from era 1 (1992–1999) vs. era 3 (2008–2015)



	NL	255.6	236.6	226.0	-29.6	7	-12%	7
	PEI	240.2	249.8	208.2	-32.0	5	-13%	5
	NS	258.6	229.0	223.6	-35.0	4	-14%	4
	NB	228.4	209.8	212.0	-16.4	10	-7%	10
	QC	253.1	232.5	206.7	-46.4	1	-18%	2
	ON	235.0	211.8	190.0	-45.0	2	-19%	1
45-54	MB	267.7	255.5	243.8	-23.9	9	-9%	9
	SK	244.3	239.9	256.5	12.2	11	5%	11
	AB	244.3	224.5	214.9	-29.4	8	-12%	6
	BC	223.6	207.4	187.8	-35.8	3	-16%	3
	Territories	294.2	279.2	263.9	-30.3	6	-10%	8
	Canada	241.6	221.1	202.2	-39.4		-16%	
	NL	720.7	599.2	523.4	-197.3	2	-27%	4
	PEI	691.5	545.9	498.2	-193.3	3	-28%	2
	NS	712.0	582.6	550.2	-161.8	5	-23%	8
	NB	661.6	552.8	505.8	-155.8	6	-24%	6
	QC	632.7	540.9	502.2	-130.5	10	-21%	9
	ON	632.2	521.7	458.6	-173.6	4	-27%	3
55-64	MB	727.0	626.4	579.0	-148.0	7	-20%	10
	SK	629.6	582.3	521.6	-108.0	11	-17%	11
	AB	619.6	542.4	474.9	-144.7	8	-23%	7
	BC	575.5	491.1	431.4	-144.1	9	-25%	5
	Territories	1046.3	754.8	615.3	-431.0	1	-41%	1
	Canada	633.3	534.4	478.7	-154.6		-24%	
	NL	1826.5	1734.3	1438.4	-388.1	8	-21%	7
	PEI	1702.8	1459.2	1288.8	-414.0	5	-24%	4
65-74	NS	1833.9	1583.3	1390.7	-443.2	4	-24%	5
05-74	NB	1672.9	1526.3	1276.5	-396.4	7	-24%	6
	QC	1631.2	1403.8	1182.2	-449.0	3	-28%	3



ON	1612.7	1402.5	1130.1	-482.6	2	-30%	1
MB	1666.1	1566.9	1354.2	-311.9	10	-19%	10
SK	1481.4	1464.0	1372.7	-108.7	11	-7%	11
AB	1539.8	1371.5	1214.9	-324.9	9	-21%	8
BC	1476.5	1279.5	1070.0	-406.5	6	-28%	2
Territories	2508.5	2464.2	1995.9	-512.6	1	-20%	9
Canada	1605.0	1407.6	1175.8	-429.2		-27%	

*Denominators for mortality rates were mid-era population sizes in years 1995, 2003, and 2011, respectively. Rankings were in order of greatest to least amount of reduction in mortality between eras.



PREMATURE MORTALITY BY CAUSE OF DEATH

Male Mortality (2008-2015)

Appendix Figure 3.2.1. Distribution of causes of death in males ages 18–34





Males, ages 35-44 NL 20% 39% 20% 17% PEI 119 NS 17% 20% 43% NB 46% 18% 18% QC 14% 19% 47% 17% ON 19% 39% 22% 46% MB 18% 20% 13% SK 41% 29% AB 13% 51% 20% 1 1.0/ BC 47% 25% 14% Territories 31% 13% Canada 44% 21% 17% 50% 30% 40% 60% 70% 0% 10% 20% 80% 90% 100% Cardiovascular/Circulatory Cancer Respiratory External Other causes

Appendix Figure 3.2.2. Distribution of causes of death in males ages 35–44

Appendix Figure 3.2.3. Distribution of causes of death in males ages 45–54







Appendix Figure 3.2.4. Distribution of causes of death in males ages 55–64

Appendix Figure 3.2.5. Distribution of causes of death in males ages 65–74





Female Mortality (2008–2015)

Females, ages 18-34 NL 11% 17% 44% 28% PEI 33% 33% NS 26% 19% 44% 7% NB 17% 50% 21% 8% QC 21% 21% 47% 24% ON 44% 21% MB 60% 21% 11% SK 6% 11% 52% 29% 60% 19% AB 4% 14% BC 49% 24% 60 18% Territories 57% 29% 1/0 Canada 50% 23% 18% 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100% Cardiovascular/Circulatory Cancer Respiratory External Other causes

Appendix Figure 3.3.1. Distribution of causes of death in females ages 18–34





Appendix Figure 3.3.2. Distribution of causes of death in females ages 35–44

Appendix Figure 3.3.3. Distribution of causes of death in females ages 45–54







Appendix Figure 3.3.4. Distribution of causes of death in females ages 55–64

Appendix Figure 3.3.5. Distribution of causes of death in females ages 65-74





PREMATURE MORTALITY BY SOCIOECONOMIC STATUS

Male Mortality

лррепик і	able 5.1.	ie 3.1.1. Fremature Mortanty by meome Quintie (deaths per 100,000 males)												
			Er	a: 2000-	2007*					Era	: 2008 –2	2015*		
Province	Q1	Q2	Q3	Q4	Q5	Absolute difference (Q1-Q5)	Rank	Q1	Q2	Q3	Q4	Q5	Absolute difference (Q1-Q5)	Rank
NL	5071	4726	4591	4232	4026	1045	3	5730	5169	4645	4564	3643	2087	4
PEI	5895	4946	4226	3949	3817	2078	9	5669	4787	3703	3784	3539	2130	5
NS	5259	4702	4110	3807	3427	1832	7	5723	4681	4326	4141	3503	2220	8
NB	5299	4821	3956	3950	3536	1763	6	5362	4684	4271	3868	3128	2235	9
QC	5249	4504	3926	3509	3045	2204	11	4749	3969	3479	3081	2570	2179	7
ON	4318	3704	3230	2949	2682	1636	5	4530	3572	3156	2787	2540	1990	2
MB	6510	4587	4082	3739	3155	3355	13	6274	4351	3758	3331	2971	3303	12
SK	6538	4960	4683	4353	3633	2905	12	6047	4399	3739	3380	3038	3008	11
AB	4389	3584	3203	2853	2502	1887	8	4299	3356	2898	2544	2301	1999	3
BC	5003	3969	3501	3246	2857	2145	10	4813	3606	3255	2946	2651	2162	6
YK	5976	4937	5572	5503	4390	1586	4	6371	4257	3471	5369	2499	3872	13
NT	2783	3013	3758	2697	3037	-255	1	3850	3410	3602	4269	3318	533	1
NU	4292	4438	4356	3756	3380	912	2	4859	6528	5534	5551	2217	2642	10

Appendix Table 5.1.1. Premature Mortality by Income Quintile (deaths per 100,000 males)

Notes: Q1= lowest income quintile, Q5= highest income quintile; Rank denotes increasing order of absolute difference between Q1 and Q5 mortality. *Per 100,000 males in 2003 and 2011 in respective eras



Drovinco	200	0-2007	2008-2015			
Province	SII	95% CI	SII	95% CI		
NL	1292.43	(1114.35 – 1470.50)	2389.15	(1761.20 – 3017.09)		
PEI	2575.62	(1574.43 - 3576.81)	2631.69	(1313.23 - 3950.16)		
NS	2279.94	(1937.71 – 2622.18)	2489.44	(1691.86 - 3287.02)		
NB	2198.56	(1482.91 – 2914.22)	2643.16	(2298.08 - 2988.23)		
QC	2701.37	(2333.27 - 3069.47)	2623.16	(2245.55 - 3000.78)		
ON	2013.51	(1580.89 – 2446.13)	2382.82	(1630.14 - 3135.51)		
MB	3778.36	(2116.97 – 5439.74)	3813.33	(2069.95 - 5556.72)		
SK	3208.42	(1946.04 - 4470.80)	3518.23	(2018.60 - 5017.86)		
AB	2252.70	(1737.62 – 2767.78)	2405.17	(1651.01 - 3159.33)		
BC	2506.69	(1685.72 - 3327.66)	2492.20	(1466.50 - 3517.90)		
YK	1303.72	(-345.30 – 2952.73)	3316.26	(-653.66 – 7286.18)		
NT	-96.81	(-1587.92 – 1394.31)	103.52	(-1260.29 – 1467.33)		
NU	1253.38	(433.05 – 2073.72)	3130.10	(-1519.41 – 7779.61)		

Appendix Table 5.1.2. Slope Index of Inequality for male premature mortality, 2000–2007 and 2008–2015

Notes: SII is interpreted as the difference in mortality between Q1 (bottom income quintile) vs. Q5 (highest income quintile); unit= deaths per 100,000 males



Drovinco	2000-	-2007	2008-2015			
Flovince	RII	95% CI	RII	95% CI		
NL	1.33	(1.29 – 1.37)	1.67	(1.55 – 11.77)		
PEI	1.79	(1.58 – 1.93)	1.88	(1.59 – 12.06)		
NS	1.73	(1.66 – 1.79)	1.77	(1.61 – 11.89)		
NB	1.68	(1.53 – 1.80)	1.90	(1.84 – 11.95)		
QC	2.00	(1.94 – 2.06)	2.16	(2.10 – 12.21)		
ON	1.85	(1.75 – 1.93)	2.12	(1.96 – 12.23)		
MB	2.50	(2.35 – 2.56)	2.71	(2.68 – 12.72)		
SK	1.99	(1.78 – 2.13)	2.49	(2.35 – 12.56)		
AB	2.03	(1.92 – 2.12)	2.28	(2.14 – 12.37)		
BC	2.02	(1.85 – 2.13)	2.13	(1.91 – 12.26)		
YK	1.28	(0.91 – 1.53)	2.21	(-0.44 – 12.45)		
NT	0.97	(0.29 – 1.35)	1.03	(0.56 - 11.33)		
NU	1.37	(1.15 – 1.53)	1.93	(-1.17 – 12.29)		

Appendix Table 5.1.3. Relative Index of Inequality for male premature mortality, 2000–2007 and 2008–2015

Note: RII is interpreted as the ratio of mortality in Q1 (bottom income quintile) vs. Q5 (highest income quintile)



Female Mortality

			Er	a: 2000-	2007*			Era: 2008–2015*						
Province	Q1	Q2	Q3	Q4	Q5	Absolute difference (Q1-Q5)	Rank	Q1	Q2	Q3	Q4	Q5	Absolute difference (Q1-Q5)	Rank
NL	3043	2798	2722	2571	2570	473	2	3661	3119	2911	2858	2205	1456	9
PEI	3142	2768	2404	2273	2497	645	3	3420	2826	2636	2171	2226	1194	3
NS	3117	2981	2552	2349	2124	993	7	3586	3044	2912	2601	2339	1247	5
NB	3127	2849	2493	2357	2192	935	6	3608	2926	2658	2326	2023	1584	11
QC	3294	2868	2441	2214	1924	1369	10	3239	2678	2340	2136	1759	1480	10
ON	2672	2379	2118	1951	1816	856	5	2855	2291	2045	1846	1693	1162	2
MB	4070	3049	2777	2390	2066	2005	13	4134	2760	2678	2118	1984	2150	13
SK	3872	3060	2816	2757	2227	1645	12	3970	2826	2511	2242	1955	2015	12
AB	2746	2399	2056	1866	1655	1090	8	2873	2246	1849	1681	1559	1314	7
BC	2932	2438	2164	2043	1798	1134	9	2968	2380	2036	1875	1684	1283	6
ҮК	4077	1757	3044	2392	2694	1383	11	3044	2945	2228	3779	1631	1412	8
NT	2074	1689	1957	1449	2103	-29	1	2396	2409	2175	2573	1158	1237	4
NU	2712	2115	2877	2067	2001	711	4	2663	3894	2908	3460	2469	194	1

Appendix Table 5.2.1. Premature Mortality by Income Quintile (deaths per 100,000 females)

Notes: Q1= lowest income quintile, Q5= highest income quintile; Rank denotes increasing order of absolute difference between Q1 and Q5 mortality. *Per 100,000 females in 2003 and 2011 in respective eras.



Drovinco	200	0-2007	2008-2015			
Province	SII	95% CI	SII	95% CI		
NL	586.41	(365.17 – 807.65)	1586.44	(1042.67 – 2130.21)		
PEI	892.78	(182.78 – 1602.78)	1521.67	(935.71 – 2107.63)		
NS	1308.98	(1082.86 - 1535.10)	1468.79	(1144.05 – 1793.52)		
NB	1180.95	(935.83 – 1426.06)	1884.58	(1470.27 – 2298.89)		
QC	1695.79	(1446.93 - 1944.66)	1750.83	(1418.71 – 2082.95)		
ON	1070.20	(871.90 – 1268.50)	1384.37	(937.65 – 1831.09)		
MB	2333.83	(1575.59 – 3092.08)	2470.89	(1252.93 - 3688.85)		
SK	1796.70	(1105.20 – 2488.19)	2306.82	(1326.62 - 3287.01)		
AB	1356.86	(1141.47 – 1572.24)	1596.43	(993.90 – 2198.97)		
BC	1330.96	(960.82 – 1701.10)	1535.98	(1042.88 - 2029.09)		
YK	1065.01	(-1765.03 – 3895.05)	995.18	(-1723.28 – 3713.65)		
NT	90.84	(-903.16 – 1084.84)	1154.76	(-401.39 – 2710.92)		
NU	734.65	(-464.87 – 1934.17)	411.12	(-1641.48 – 2463.73)		

Appendix Table 5.2.2. Slope Index of Inequality for female premature mortality, 2000–2007 and 2008–2015

Notes: SII is interpreted as the difference in mortality between Q1 (bottom income quintile) vs. Q5 (highest income quintile); unit= deaths per 100,000 females



Drovinco	2000-	-2007	2008-2015				
Province	RII	95% CI	RII	95% CI			
NL	1.24	(1.16 - 1.31)	1.74	(1.56 – 1.86)			
PEI	1.41	(1.10 – 1.62)	1.80	(1.60 – 1.94)			
NS	1.66	(1.59 – 1.73)	1.68	(1.58 – 1.76)			
NB	1.59	(1.50 – 1.66)	2.07	(1.96 – 2.15)			
QC	2.00	(1.93 – 2.05)	2.13	(2.04 – 2.19)			
ON	1.65	(1.57 – 1.72)	1.95	(1.78 – 2.07)			
MB	2.37	(2.24 – 2.45)	2.65	(2.57 – 2.68)			
SK	1.88	(1.67 – 2.02)	2.49	(2.35 – 2.56)			
AB	1.93	(1.85 – 1.99)	2.28	(2.11 – 2.38)			
BC	1.83	(1.69 – 1.93)	2.08	(1.92 – 2.19)			
YK	1.47	(-1.78 – 2.00)	1.45	(-1.59 – 1.98)			
NT	1.05	(0.27 – 1.46)	1.74	(0.40 - 2.10)			
NU	1.37	(0.64 – 1.72)	1.14	(0.03 - 1.61)			

Appendix Table 5.2.3. Relative Index of Inequality for female premature mortality, 2000–2007 and 2008–2015

Note: RII is interpreted as the ratio of mortality in Q1 (bottom income quintile) vs. Q5 (highest income quintile)